

# 2003 RUTGERS Turfgrass Proceedings



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# **2003 RUTGERS TURFGRASS PROCEEDINGS**

of the

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The Rutgers Turfgrass Proceedings is published yearly by the Rutgers Center for Turfgrass Science, Rutgers Cooperative Extension, and the New Jersey Agricultural Experiment Station, Cook College, Rutgers, The State University of New Jersey in cooperation with the New Jersey Turfgrass Association. The purpose of this document is to provide a forum for the dissemination of information and the exchange of ideas and knowledge. The proceedings provide turfgrass managers, research scientists, extension specialists, and industry personnel with opportunities to communicate with co-workers. Through this forum, these professionals also reach a more general audience, which includes the public.

This publication includes lecture notes of papers presented at the 2003 New Jersey Turfgrass Expo. Publication of these lectures provides a readily available source of information covering a wide range of topics and includes technical and popular presentations of importance to the turfgrass industry.

This proceedings also includes research papers that contain original research findings and reviews of selected subjects in turfgrass science. These papers are presented primarily to facilitate the timely dissemination of original turfgrass research for use by the turfgrass industry.

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Dr. Ann Brooks Gould, Editor  
Dr. Bruce B. Clarke, Coordinator

# SUPPRESSION OF ANTHRACNOSE ON AN ANNUAL BLUEGRASS PUTTING GREEN WITH SELECTED FUNGICIDES, NITROGEN, PLANT GROWTH REGULATORS, AND HERBICIDES

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Fungicides were evaluated in 2003 for their ability to control anthracnose basal rot (caused by *Colletotrichum graminicola*) on a practice putting green at the Ridgewood Country Club in Paramus, NJ. The green was established in 1965 on an 80:20 (sand:soil) base. Turf was approximately 70% annual bluegrass (*Poa annua*) and 30% creeping bentgrass (*Agrostis stolonifera* Pennncross). Mowing was performed six times weekly at a height of 0.115 to 0.130 inches with clippings collected. The site was irrigated as needed to prevent drought stress.

Fertilizer was applied to the entire study as Phytofos K (6 oz/1000 ft<sup>2</sup>) plus Root 1-2-3 (0.12 oz nitrogen (N)/1000 ft<sup>2</sup>) on 3 April, a custom greens mix of Endoroots 3-3-4 (0.6 lb N/1000 ft<sup>2</sup>), Ecolite (10 lb/1000 ft<sup>2</sup>), and Gypsum (5 lb/1000 ft<sup>2</sup>) on 14 April, a mix including FE 12-0-0 (0.4 oz N/1000 ft<sup>2</sup>), Phytofos K (6 oz/1000 ft<sup>2</sup>), Roots 1-2-3 (0.9 oz N/1000 ft<sup>2</sup>), Plant Food 12-3-12 (1.1 oz N/1000 ft<sup>2</sup>), and Boron (12 oz/1000 ft<sup>2</sup>) on 28 April, a mixture of Plant Food 12-3-12 (1.3 oz N/1000 ft<sup>2</sup>) and Adams Earth (6 oz/1000 ft<sup>2</sup>) applied on 5 May, 16 June, 30 June, and 11 and 28 July, and Plant Food 12-3-12 (1.9 oz N/1000 ft<sup>2</sup>) on 27 May, 7 July, and 4 August. Additional nutritional supplements and micronutrients were applied as Ecolite (10 lb/1000 ft<sup>2</sup>) on 14 April, as Gypsum (5 lb/1000 ft<sup>2</sup>) on 14 April, as Boron (22 oz/1000 ft<sup>2</sup>) on 28 April, 16 June, and 4 August, and as Sugar Cal (6 oz/1000 ft<sup>2</sup>) on 30 June and 4 August. Localized dry spots were controlled with Hydration wetting agent (2 fl oz/1000 ft<sup>2</sup>) on 5 and 19 May, 23 June, 7 July, and 18 August. Insect pests were controlled with Triumph 4E (0.5 fl oz/1000 ft<sup>2</sup>) and Battle GC (10 fl oz/A) on 5 May, and with Merit 75WSP (0.15 oz/1000 ft<sup>2</sup>) and Tempo 20WP (0.17 oz/1000 ft<sup>2</sup>) on 7 July.

Prior to the initiation of the trial, Embark 2S growth regulator (2 fl oz/1000 ft<sup>2</sup>) was applied on 3 April and 28 April. The green was topdressed with 0.03 inches of Harford TD 1000 85:15 (sand:peat) mix on 15 February and 13 March, 0.25 inches on 15 April, and 0.03 inches on 6, 13, and 20 May and 2, 9, and 17 September. Turf was aerated on 6 and 19 March with 0.375-inch solid tines on 2-inch centers, vertidraind on 14 April with 0.75-inch solid tines on a 3 x 6 inch spacing, aerated on 14 April with 0.625-inch hollow tines on 2-inch centers, and cultivated using a Graden verticutter at a 0.078-inch depth and a 1-inch spacing on 15 April. Plots were 3 x 9 ft and were arranged in a randomized complete block with four replications. Half of each plot received an additional 0.125 lb N (urea)/1000 ft<sup>2</sup> as a foliar spray in 2 gal water/1000 ft<sup>2</sup> from 12 May through 18 August and was immediately irrigated with 0.05 inches of water just prior to fungicide treatments.

Fungicides were applied in water equivalent to 2 gal per 1000 ft<sup>2</sup> with a CO<sub>2</sub> powered sprayer at 30 psi using TeeJet 8003E nozzles. Treatments (trt) were initiated on 12 May, prior to the development of anthracnose. Fungicides were reapplied every 14 days until 18 August. Turf was visually evaluated for percent turf area infested with anthracnose per plot on 16 and 30 June, 14 and 28 July, 13 and 25 August, and 8 September. Turf quality was evaluated on 25 August using a 1 to 9 scale, where 9 = best turf quality. Data were subjected to analysis of variance and means were separated using the Waller-Duncan *k*-ratio *t*-test (*k* = 100).

The disease developed naturally on 4 June and became uniformly distributed on the green by 16 June.

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Only annual bluegrass was infested with *C. graminicola*. Disease severity peaked on 25 August (81% turfgrass area infected on non-fungicide treated turf). Most fungicide entries provided good to excellent disease control during the 12 May to 18 August application period, except for Cleary 3336 50W (trt 5), ProStar 70WG (trt 7), Insignia 20WG (trt 10), Curalan 50DF (trt 11), Bayleton 50DF (trt 16), Fore Rainshield 80W (trt 20), and Chipco 26GT 2SC (trt 23). On the final rating date (8 September, 21 days post-treatment) only Chipco Triton 70WG (trt 18), Chipco Triton 70WG + Chipco Signature 80WG (trt 19), Daconil Ultrex 82.5SDG + Chipco Signature 80WG (trt 24), and rotational program 4 (trt 36) adequately suppressed disease symptoms (Tables 1 and 2).

Of the DMI fungicides, only Banner Maxx 1.3MC (trts 2, 13) and Chipco Triton 70WG (trt 18) provided adequate control of anthracnose, whereas Bayleton 50DF (trt 16) proved ineffective. The phosphonate Chipco Signature 80WDG (trt 1), the polyoxin-D antibiotic Endorse 2.5W at the 6 oz rate (trt 9), and the phenylpyrrole Medallion 50W (trts 27-28) provided good to excellent disease suppression. Interestingly, the phosphonate Alude 46LC significantly enhanced disease control after 13 August when applied in combination with Spectro 90WDG (trt 4) or Endorse 2.5W (trt 6), compared to these products alone (trts 3 and

8, respectively). Tank mixtures and rotational programs (i.e., applying products from different chemical classes every two weeks), even when used at reduced rates, provided excellent disease control that was typically equivalent to or better than single product entries. On most rating dates, the plant growth regulator Primo MAXX 1MC (trt 25) consistently reduced disease severity (29 to 88%), whereas the combination of the growth regulators Proxy 2L and Primo MAXX 1MC (trt 21) enhanced anthracnose (22 to 53%) only during the first three rating dates, compared to untreated turf (trt 40).

Prior to the appearance of phytotoxicity (foliar necrosis) on 30 June, the pre-emergence herbicide Dimension 1EC (trt 26) dramatically enhanced anthracnose (48 to 88%) compared to the untreated control (trt 40). In all cases, the addition of Daconil Ultrex 82.5SDG to Dimension 1EC (trt 30) or to Proxy 2L + Primo MAXX 1MC (trt 34) prevented the increase in disease severity previously noted. The addition of nitrogen (+N) to half of each plot reduced anthracnose (8 to 52%) compared to the -N portion of each plot (see Tables 1 and 2). Turf quality was closely associated with the severity of anthracnose basal rot (Table 2). Other than a dark green color induced by the DMI fungicides, and severe necrosis caused by Dimension 1EC (trts 26, 30), no other phytotoxicity was observed.

Table 1. Suppression of anthracnose with nitrogen, fungicides, plant growth regulators, and herbicides on a *Poa/Bent*grass green at Ridgewood Country Club, NJ, 2003.

Treatment and Rate per 1000 sq ft	Spray Interval (days) <sup>y</sup>	MOA <sup>x</sup>	Turf Area Infested (%) per Plot <sup>z</sup>							
			16 June		30 June		14 July		28 July	
			+N	-N	+N	-N	+N	-N	+N	-N
1. Chipco Signature 80WG 4.0 oz .....	14	1	1.0 ab	4.8 e	1.0 ab	1.8 a-c	1.3 a-c	8.5 ef	7.8 c-e	24.0 d
2. Banner Maxx 1.3MC 0.75 fl oz .....	14	7	0.0 a	0.5 a	0.8 ab	1.8 a-c	2.3 a-d	5.0 a-e	4.3 a-d	8.5 a-c
3. Spectro 90WDG 3.67 oz .....	14	3, 8	0.0 a	0.8 ab	0.3 ab	1.5 ab	1.8 a-c	4.3 a-e	1.8 a-c	11.3 bc
4. Spectro 90WDG 3.67 oz .....	---	3,8								
+ Alude 46LC 5.5 fl oz .....	14	4	0.0 a	0.0 a	0.3 ab	0.5 ab	1.5 a-c	2.3 a-c	3.0 a-c	8.0 a-c
5. Cleary 3336 50W 6.0 oz .....	14	3	2.5 a-c	12.3 g	1.3 b	4.0 cd	5.5 e	13.3 fg	19.8 g	51.5 g
6. Endorse 2.5W 4.0 oz .....	---	6								
+ Alude 46LC 5.5 fl oz .....	14	4	0.0 a	0.0 a	0.0 a	1.8 a-c	0.5 ab	2.8 a-d	1.5 a-c	3.5 a-c
7. Prostar 70WG 2.2 oz .....	14	5	0.0 a	1.8 a-c	0.5 ab	6.8 ef	9.0 f	30.3 j	17.3 fg	55.3 g
8. Endorse 2.5W 4.0 oz .....	14	6	0.0 a	0.0 a	0.8 ab	2.8 bc	1.3 a-c	8.0 de	1.3 a-c	12.0 c
9. Endorse 2.5W 6.0 oz .....	14	6	0.0 a	0.0 a	0.3 ab	0.5 ab	0.5 ab	2.8 a-d	0.5 ab	4.0 a-c
10. Insignia 20WG 0.5 oz .....	14	2	0.0 a	0.0 a	0.8 ab	2.3 a-c	2.3 a-d	7.8 c-e	9.3 de	28.0 de
11. Curalan 50DF 1.0 oz .....	14	12	4.0 c	16.0 h	0.0 a	6.0 de	4.8 de	20.5 hi	11.0 e	54.5 g
12. Daconil Ultrex 82.5SDG 3.2 oz .....	14	8	0.0 a	0.0 a	0.0 a	1.0 ab	0.5 ab	1.5 ab	0.5 ab	5.3 a-c
13. Banner MAXX 1.3MC 1.0 fl oz .....	14	7	0.0 a	0.0 a	0.0 a	0.3 ab	0.3 ab	3.8 a-e	0.0 a	0.5 a
14. Banner MAXX 1.3MC 0.75 fl oz .....	---	7								
+ Daconil Ultrex 82.5SDG 2.4 oz .....	14	8	0.0 a	0.0 a	0.0 a	0.0 a	0.5 ab	2.3 a-c	0.5 ab	0.5 a
15. Insignia 20WG 0.5 oz .....	---	2								
+ Concorde 82.5DF 3.2 oz .....	14	8	0.0 a	0.0 a	0.3 ab	0.3 ab	0.8 ab	2.0 ab	0.5 ab	7.5 a-c
16. Bayleton 50DF 1.0 oz .....	14	7	0.0 a	2.3 a-e	0.3 ab	1.5 ab	5.5 e	15.0 g	12.8 ef	56.3 g
17. Insignia 20WG 0.5 oz .....	---	2								
+ Propiconazole PRO 1.3MC 1.0 fl oz .....	14	7	0.0 a	0.0 a	0.3 ab	0.8 ab	0.5 ab	1.8 ab	0.0 a	1.3 a
18. Chipco Triton 70WG 0.3 oz .....	14	7	0.0 a	0.3 a	0.0 a	0.3 ab	10.8 f	14.0 g	0.0 a	1.5 ab
19. Chipco Triton 70WG 0.3 oz .....	---	7								
+ Chipco Signature 80WG 4.0 oz .....	14	1	0.0 a	0.0 a	0.0 a	0.0 a	3.8 c-e	6.5 b-e	0.0 a	0.0 a
20. Fore Rainshield 80W 8.0 oz .....	14	9	0.0 a	0.3 a	0.0 a	0.8 ab	0.0 a	0.5 a	2.3 a-c	11.5 c

(Continued)

Table 1 (continued).

Treatment and Rate per 1000 sq ft	Spray Interval (days) <sup>y</sup>	MOA <sup>x</sup>	Turf Area Infested (%) per Plot <sup>z</sup>							
			16 June		30 June		14 July		28 July	
			+N	-N	+N	-N	+N	-N	+N	-N
21. Proxy 2L 5.0 fl oz	Twice <sup>w</sup>	14	8.5 d	25.8 i	2.5 c	8.3 f	5.3 e	22.3 i	7.0 b-e	40.3 f
+ Primo MAXX 1MC 0.125 fl oz	14 <sup>w</sup>	13	0.0 a	0.0 a	0.0 a	1.0 ab	0.3 ab	4.0 a-e	0.0 a	5.3 a-c
22. Chipco 26GT 2SC 4.0 fl oz		12	0.0 a	2.0 a-d	0.3 ab	2.8 bc	3.0 b-e	13.3 fg	10.8 e	33.5 ef
+ Chipco Signature 80WG 4.0 oz	14	1	0.0 a	0.0 a	0.0 a	0.5 ab	0.0 a	0.5 a	0.0 a	1.0 a
23. Chipco 26GT 2SC 4.0 fl oz		12	0.0 a	0.0 a	0.3 ab	2.8 bc	3.5 c-e	13.8 g	2.8 a-c	34.3 ef
24. Daconil Ultrex 82.5SDG 3.2 oz		8	32.0 e	34.8 j	ND <sup>n</sup>	ND	ND	ND	ND	ND
+ Chipco Signature 80WG 4.0 oz	14	1	0.0 a	0.0 a	0.0 a	0.5 ab	0.0 a	0.5 a	0.0 a	1.0 a
25. Primo MAXX 1MC 0.125 fl oz		13	3.0 bc	8.0 f	0.3 ab	2.8 bc	3.5 c-e	13.8 g	2.8 a-c	34.3 ef
26. Dimension 1EC 1.1 fl oz	Once <sup>v</sup>	15	0.5 ab	3.5 c-e	0.0 a	0.8 ab	0.0 a	0.5 a	0.0 a	0.3 a
27. Medallion 50W 0.25 oz		14	0.0 a	0.5 a	0.3 ab	0.5 ab	0.3 ab	0.8 a	0.3 ab	1.3 a
28. Medallion 50W 0.33 oz		14	0.0 a	0.0 a	0.0 a	0.5 ab	0.8 ab	1.5 ab	0.5 ab	4.3 a-c
29. Primo MAXX 1MC 0.125 fl oz		13	0.0 a	0.0 a	0.0 a	0.5 ab	0.8 ab	1.5 ab	0.5 ab	4.3 a-c
+ Daconil Ultrex 82.5SDG 2.4 oz	14	8	0.0 a	0.0 a	0.0 a	0.5 ab	0.8 ab	1.5 ab	0.5 ab	4.3 a-c
30. Dimension 1EC 1.1 fl oz	Once <sup>v</sup>	15	4.0 c	4.5 de	ND	ND	ND	ND	ND	ND
+ Daconil Ultrex 82.5SDG 2.4 oz	14 <sup>v</sup>	8	0.0 a	0.0 a	2.5 c	7.0 ef	1.3 a-c	7.0 b-e	1.3 a-c	9.5 a-c
31. Rotational Program 1		---	0.0 a	0.0 a	0.0 a	0.3 ab	0.0 a	0.0 a	0.3 ab	0.8 a
32. Rotational Program 2		---	0.0 a	0.0 a	0.0 a	0.3 ab	0.0 a	0.0 a	0.3 ab	0.8 a
33. Rotational Program 3		---	0.0 a	0.0 a	0.8 ab	0.5 ab	0.5 ab	2.3 a-c	0.5 ab	0.8 a
34. Proxy 2L 5.0 fl oz	Twice <sup>w</sup>	14	0.5 ab	3.3 b-e	0.8 ab	2.5 a-c	0.8 ab	3.3 a-e	0.0 a	0.3 a
+ Primo MAXX 1MC 0.125 fl oz	---	13	0.0 a	0.0 a	0.0 a	0.8 ab	0.3 ab	2.0 ab	1.8 a-c	8.0 a-c
+ Daconil Ultrex 82.5SDG 2.4 oz	14 <sup>w</sup>	8	0.0 a	0.0 a	0.0 a	0.0 a	0.5 ab	1.8 ab	0.0 a	0.8 a
35. Daconil Ultrex 82.5SDG 2.4 oz		14	0.0 a	0.0 a	0.0 a	0.8 ab	0.8 ab	2.8 a-d	0.3 ab	1.0 a
36. Rotational Program 4		---	0.0 a	0.0 a	0.5 ab	0.8 ab	0.8 ab	2.0 ab	0.0 a	5.8 a-c
37. Rotational Program 5		---	0.0 a	0.0 a	0.0 a	0.8 ab	0.8 ab	2.0 ab	0.0 a	5.8 a-c
38. Endorse 2.5W 3.0 oz		6	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.3 a	0.0 a	0.0 a
+ Daconil Ultrex 82.5SDG 2.4 oz	14	8	0.0 a	0.0 a	0.0 a	0.3 ab	0.0 a	0.3 a	0.0 a	0.0 a
39. Medallion 50W 0.188 oz		10	4.0 c	18.3 h	2.5 c	4.0 cd	8.8 f	16.0 gh	25.5 h	53.5 g
+ Daconil Ultrex 82.5SDG 2.4 oz	14	8	0.0 a	0.0 a	0.0 a	0.3 ab	0.0 a	0.3 a	0.0 a	0.0 a
40. Untreated Control		---	4.0 c	18.3 h	2.5 c	4.0 cd	8.8 f	16.0 gh	25.5 h	53.5 g

(Continued)

Table 1 (continued).

		Turf Area Infested (%) per Plot <sup>z</sup>							
		16 June		30 June		14 July		28 July	
Spray Interval	(days) <sup>y</sup>	MOA <sup>x</sup>	+N	-N	+N	-N	+N	-N	+N
INT <sup>p</sup>			DAT <sup>o</sup>	DAT	DAT	DAT	DAT	DAT	DAT
Once			35	49	63	77	63	77	63
Twice			21	35	49	63	49	63	63
14			7	7	7	7	7	7	7

<sup>z</sup> Values are means of four replications. Means followed by the same letter are not significantly different according to Waller-Duncan k-ratio t-test ( $k = 100$ ).

<sup>y</sup> Fungicides were applied on 12 and 27 May, 9 and 23 June, 7 and 21 July, and 4 and 18 August.

<sup>x</sup> Class = Chemical Class, where 1 = phosphonate, 2 = Qol (includes strobilurin fungicides), 3 = benzimidazole, 4 = macro nutrients P and K, 5 = carboximide, 6 = Polyoxin-D (antibiotic), 7 = sterol biosynthesis inhibitor/demethylation inhibitor, 8 = nitrite, 9 = dithiocarbamate, 10 = phenylpyrrole, 11 = phenylamide, 12 = dicarboximide fungicide class, 13 = class A plant growth regulator, 14 = class E plant growth regulator, and 15 = pyridine pre-emergence herbicide.

<sup>w</sup> For treatments 21 and 34, Proxy 2L was applied twice (12 May and 26 May), whereas Primo MAXX 1MC (treatment 21) and Primo MAXX 1MC + Daconil Ultrex 82.5SDG (treatment 34) were sprayed every 14 days. Phytotoxicity on a 1 to 9 scale, where 1 = no injury, 2 = 1-5%, 3 = 5-15%, 4 = 15-30%, 5 = 30-50%, 6 = 50-70%, 7 = 70-85%, 8 = 85-95%, and 9 = 95-100% foliar necrosis, was observed for treatment 21 (2.5 +N, 5.5 -N on 30 June; 1.0 +N, 1.0 -N on 14 July; 1.0 +N, 1.0 -N on 28 July) and treatment 34 (2.0 +N, 3.5 -N on 30 June; 1.0 +N, 1.0 -N on 14 July; 1.0 +N, 1.0 -N on 28 July).

<sup>v</sup> For treatments 26 and 30, Dimension 1EC was only applied once (12 May), whereas Daconil Ultrex 82.5SDG (treatment 30) was applied every 14 days. Phytotoxicity on a 1 to 9 scale, where 1 = 0 injury, 2 = 1-5%, 3 = 5-15%, 4 = 15-30%, 5 = 30-50%, 6 = 50-70%, 7 = 70-85%, 8 = 85-95%, and 9 = 95-100% foliar necrosis, was observed for treatment 26 (6.0 +N, 6.5 -N on 16 June; 5.0 +N, 6.8 -N on 30 June; 7.0 +N, 6.2 -N on 14 July; 5.5 +N, 6.8 -N on 28 July; 3.6+N, 4.0-N on 13 August) and treatment 30 (3.3 +N, 6.3 -N on 16 June; 4.3 +N, 6.5 -N on 30 June; 5.0 +N, 5.2 -N on 14 July; 3.5 +N, 4.8 -N on 28 July; 1.8+N, 2.8-N on 13 August).

<sup>u</sup> Rotational Program 1 (modified USGA) was applied as follows: Heritage 50WG (0.2 oz) + Daconil Ultrex 82.5SDG (1.8 oz) on 12 May, Chipco Signature 80WG (4.0 oz) + Fore Rainshield 80W (6.0 oz) on 26 May, Heritage 50WG (0.2 oz) + Daconil Ultrex 82.5SDG (2.4 oz) on 9 June, Chipco Signature 80WG (4.0 oz) + Daconil Ultrex 82.5SDG (2.4 oz) on 23 June, Heritage 50WG (0.2 oz) + Daconil Ultrex 82.5SDG (2.4 oz) on 7 July, Chipco Signature 80WG (4.0 oz) + Fore Rainshield 80W (6.0 oz) on 21 July, Heritage 50WG (0.2 oz) + Daconil Ultrex 82.5SDG (2.4 oz) on 4 August, and Chipco Signature 80WG (4.0 oz) + Daconil Ultrex 82.5SDG (2.4 oz) on 18 August. All rates were per 1000 sq ft.

(Continued)



Table 1 (continued).

- <sup>t</sup> Rotational Program 2 (Syngenta) was applied as follows: Banner MAXX 1.3MC (2 fl oz) + Daconil Ultrex 82.5SDG (1.8 oz) + Primo MAXX 1MC (0.125 fl oz) on 12 May, Heritage 50WG (0.4 oz) + Daconil Ultrex 82.5SDG (3.2 oz) + Primo MAXX 1MC (0.125 fl oz) on 27 May, Medallion 50W (0.25 oz) + Daconil Ultrex 82.5SDG (3.2 oz) + Primo MAXX 1MC (0.125 fl oz) on 9 June, Heritage 50WG (0.4 oz) + Banner MAXX 1.3MC (1.0 fl oz) + Primo MAXX 1MC (0.125 fl oz) on 23 June, Medallion 50W (0.25 oz) + Daconil Ultrex 82.5SDG (3.2 oz) + Primo MAXX 1MC (0.125 fl oz) on 7 July, Heritage 50WG (0.4 oz) + Banner MAXX 1.3MC (1.0 fl oz) + Primo MAXX 1MC (0.125 fl oz) on 21 July, Medallion 50W (0.25 oz) + Daconil Ultrex 82.5SDG (3.2 oz) + Primo MAXX 1MC (0.125 fl oz) on 4 August, and Banner MAXX 1.3MC (1.0 fl oz) + Daconil Ultrex 82.5SDG (3.2 oz) + Primo MAXX 1MC (0.125 fl oz) on 18 August. All rates were per 1000 sq ft.
- <sup>s</sup> Rotational Program 3 (Bayer) was applied as follows: Chipco Signature 80WG (4.0 oz) + Chipco 26GT 2SC (4.0 fl oz) on 12 May, Chipco Signature 80WG (4.0 oz) + Daconil Ultrex 82.5SDG (3.2 oz) on 27 May, Chipco Signature 80WG (4.0 oz) + Bayleton 50DF (1.0 oz) + Daconil Ultrex 82.5SDG (3.2 oz) on 9 June, Chipco Signature 80WG (4.0 oz) + Compass 50WG (0.2 oz) + Daconil Ultrex 82.5SDG (3.2 oz) on 23 June, Chipco Signature 80WG (4.0 oz) + Chipco 26GT 2SC (4 fl oz) on 7 July, Chipco Signature 80WG (4.0 oz) + Daconil Ultrex 82.5SDG (3.2 oz) on 21 July, Chipco Signature 80WG (4.0 oz) + Chipco 26GT 2SC (4 fl oz) on 4 August, and Chipco Signature 80WG (4 oz) on 18 August. All rates were per 1000 sq ft.
- <sup>r</sup> Rotational Program 4 (Rutgers) was applied as follows: Chipco 26GT 2SC (4.0 fl oz) on 12 May, Banner MAXX 1.3MC (1 fl oz) on 27 May, Daconil Ultrex 82.5SDG (3.2 oz) on 9 June, Chipco Signature 80WG (4.0 oz) + Daconil Ultrex 82.5SDG (2.4 oz) on 23 June, Medallion 50W (0.188 oz) + Banner MAXX 1.3MC (0.75 fl oz) on 7 July, Chipco Signature 80WG (4.0 oz) + Daconil Ultrex 82.5SDG (2.4 oz) on 21 July, Endorse 2.5W (3.0 oz) + Banner MAXX 1.3MC (0.75 fl oz) on 4 August, and Chipco Signature 80WG (4.0 oz) + Daconil Ultrex 82.5SDG (2.4 oz) on 18 August. All rates were per 1000 sq ft.
- <sup>q</sup> Rotational Program 5 (Rutgers) was applied as follows: Banner MAXX 1.3MC (1.0 fl oz) on 12 May, Daconil Ultrex 82.5SDG (3.2 oz) on 27 May, Chipco 26GT 2SC (4.0 fl oz) on 9 June, Chipco Signature 80WG (4.0 oz) + Daconil Ultrex 82.5SDG (2.4 oz) on 23 June, Endorse 2.5W (3.0 oz) + Daconil Ultrex 82.5SDG (2.4 oz) on 7 July, Chipco Signature 80WG (4.0 oz) + Daconil Ultrex 82.5SDG (2.4 oz) on 21 July, Medallion 50W (0.188 oz) + Daconil Ultrex 82.5SDG (2.4 oz) on 4 August, and Chipco Signature 80WG (4.0 oz) + Daconil Ultrex 82.5SDG (2.4 oz) on 18 August. All rates were per 1000 sq ft.
- <sup>p</sup> Spray interval in days.
- <sup>o</sup> Days after treatment (DAT) for each spray interval.
- <sup>n</sup> ND = No data taken due to phytotoxicity.



Table 2. Suppression of anthracnose with nitrogen, fungicides, plant growth regulators, and herbicides on a *Poa/Bent*grass green at Ridgewood Country Club, NJ, 2003.

Treatment and Rate per 1000 sq ft	Spray Interval (days) <sup>x</sup>	MOA <sup>w</sup>	Turf Area Infested (%) per Plot <sup>z</sup>												Turf Quality <sup>y</sup>	
			13 Aug.			25 Aug.			8 Sept.			25 Aug.				
			+N	-N	-N	+N	-N	-N	+N	-N	+N	-N	+N	-N		
1. Chipco Signature 80WG 4.0 oz	14	1	7.0 bc	11.5 cd	1.8 ab	12.8 c-e	15.0 a-c	36.0 d-i	9.0 l	6.5 de						
2. Banner Maxx 1.3MC 0.75 fl oz	14	7	1.5 ab	9.0 a-d	7.0 a-d	12.8 c-e	30.5 d-h	63.5 mn	8.0 j-l	6.3 d						
3. Spectro 90WDG 3.67 oz	14	3, 8	1.0 a	3.0 a-c	6.8 a-d	13.3 de	41.5 h-l	70.0 n-q	8.3 j-l	7.0 d-g						
4. Spectro 90WDG 3.67 oz	---	3, 8														
+ Alude 46LC 5.5 fl oz	14	4	0.0 a	0.5 ab	0.0 a	2.0 ab	16.0 a-c	35.0 d-h	9.0 l	8.3 h-j						
5. Cleary 3336 50W 6.0 oz	14	3	22.5 fg	51.5 gh	57.8 gh	69.5 i	51.3 l	64.3 m-o	6.8 gh	4.5 bc						
6. Endorse 2.5W 4.0 oz	---	6														
+ Alude 46LC 5.5 fl oz	14	4	0.0 a	2.0 a-c	0.0 a	3.0 a-c	10.8 ab	25.5 b-e	9.0 l	7.5 e-i						
7. Prostar 70WG 2.2 oz	14	5	27.5 gh	63.0 i	59.0 h	79.5 j	67.8 mn	82.8 qr	6.0 f-g	3.8 b						
8. Endorse 2.5W 4.0 oz	14	6	0.5 a	15.0 d	10.3 b-d	24.5 fg	31.8 d-i	55.0 j-m	8.0 j-l	7.0 d-g						
9. Endorse 2.5W 6.0 oz	14	6	2.0 ab	5.0 a-c	4.3 a-c	11.8 b-e	19.8 b-d	49.3 i-l	8.3 j-l	7.3 d-h						
10. Insignia 20WG 0.5 oz	14	2	17.5 ef	41.5 f	43.8 ef	75.5 ij	48.3 kl	83.2 qr	5.8 e-f	3.8 b						
11. Curalan 50DF 1.0 oz	14	12	38.0 i	65.0 i	68.0 ij	75.5 ij	78.8 n-p	94.0 r	4.8 c-d	4.0 bc						
12. Daconil Ultrex 82.5SDG 3.2 oz	14	8	0.5 a	6.0 a-d	5.8 a-d	9.5 a-d	44.0 i-l	56.0 k-m	8.3 j-l	7.3 d-h						
13. Banner MAXX 1.3MC 1.0 fl oz	14	7	0.0 a	4.5 a-c	3.3 a-c	9.8 a-d	26.5 c-f	40.8 g-i	8.3 j-l	7.0 d-g						
14. Banner MAXX 1.3MC 0.75 fl oz	---	7														
+ Daconil Ultrex 82.5SDG 2.4 oz	14	8	0.0 a	0.0 a	0.0 a	0.0 a	18.8 b-d	26.3 b-f	8.8 l	8.8 j						
15. Insignia 20WG 0.5 oz	---	2														
+ Concorde 82.5DF 3.2 oz	14	8	0.0 a	6.5 a-d	13.0 d	19.8 ef	50.0 kl	81.0 p-r	7.8 i-k	6.5 de						
16. Bayleton 50DF 1.0 oz	14	7	37.5 i	55.0 h	72.3 j	75.0 ij	76.8 n-p	84.5 qr	4.3 bc	4.3 bc						
17. Insignia 20WG 0.5 oz	---	2														
+ Propiconazole PRO 1.3MC 1.0 fl oz	14	7	0.0 a	2.0 a-c	5.8 a-d	9.3 a-d	21.3 b-d	39.8 g-i	8.5 kl	6.3 d						
18. Chipco Triton 70WG 0.3 oz	14	7	0.0 a	3.0 a-c	0.0 a	1.3 a	9.8 ab	15.8 ab	9.0 l	7.5 e-i						
19. Chipco Triton 70WG 0.3 oz	---	7														
+ Chipco Signature 80WG 4.0 oz	14	1	0.0 a	0.0 a	0.0 a	0.0 a	3.5 a	5.8 a	9.0 l	8.8 j						
20. Fore Rainshield 80W 8.0 oz	14	9	9.5 cd	43.0 fg	63.8 hi	58.3 h	84.5 p	85.0 qr	5.5 d-f	5.0 c						

(Continued)

Table 2 (continued).

	Spray Interval	MOA <sup>w</sup>	Turf Area Infested (%) per Plot <sup>z</sup>						Turf Quality <sup>y</sup> 25 Aug.	
			13 Aug.	25 Aug.	8 Sept.	25 Aug.	8 Sept.	25 Aug.		
Treatment and Rate per 1000 sq ft	(days) <sup>x</sup>		+N	-N	+N	-N	+N	-N	+N	-N
21. Proxy 2L 5.0 fl oz	Twice <sup>v</sup>	14	30.5 h	47.5 f-h	85.3 k	82.8 j	82.8 op	88.0 qr	3.8 b	5.0 c
+ Primo MAXX 1MC 0.125 fl oz	14 <sup>v</sup>	13	0.0 a	8.0 a-d	0.0 a	5.5 a-d	20.3 b-d	30.3 c-g	9.0 l	7.5 e-i
22. Chipco 26GT 2SC 4.0 fl oz	---	12	29.5 h	53.0 h	50.5 fg	73.0 ij	72.5 m-p	84.3 qr	5.0 c-e	4.3 bc
+ Chipco Signature 80WG 4.0 oz	14	1	0.0 a	0.5 ab	0.0 a	0.0 a	10.3 ab	15.8 ab	9.0 l	8.5 j
23. Chipco 26GT 2SC 4.0 fl oz	14	12	14.0 de	30.0 e	72.3 j	57.5 h	71.8 m-o	67.8 m-p	4.5 bc	4.8 bc
24. Daconil Ultrex 82.5SDG 3.2 oz	---	8	ND <sup>m</sup>	ND	ND	ND	ND	ND	2.5 a	2.3 a
+ Chipco Signature 80WG 4.0 oz	14	1	1.0 a	4.0 a-c	10.8 cd	20.5 ef	20.5 b-d	38.8 f-i	8.3 j-l	6.5 de
25. Primo MAXX 1MC 0.125 fl oz	14	13	1.5 ab	3.0 a-c	10.5 b-d	21.0 ef	23.0 b-e	43.3 g-k	8.0 j-l	6.5 de
26. Dimension 1EC 1.1 fl oz	Once <sup>u</sup>	15	0.0 a	2.0 a-c	7.8 a-d	6.0 a-d	46.5 j-l	55.8 j-m	7.0 hi	7.0 d-g
27. Medallion 50W 0.25 oz	14	10	1.5 ab	10.0 b-d	4.5 a-d	7.0 a-d	34.3 e-j	59.5 l-n	4.8 cd	4.5 bc
28. Medallion 50W 0.33 oz	14	10	0.0 a	1.5 ab	1.0 a	3.5 a-d	39.3 g-l	48.0 h-l	8.5 k	7.3 d-h
29. Primo MAXX 1MC 0.125 fl oz	---	13	0.0 a	4.5 a-c	0.0 a	3.0 a-c	20.5 b-d	37.5 e-i	7.5 h-j	6.8 d-f
+ Daconil Ultrex 82.5SDG 2.4 oz	14	8	0.0 a	2.0 a-c	7.8 a-d	6.0 a-d	46.5 j-l	55.8 j-m	9.0 l	7.8 f-j
30. Dimension 1EC 1.1 fl oz	Once <sup>u</sup>	15	ND	ND	40.7 ef	30.7 g	ND	ND	4.8 cd	4.5 bc
+ Daconil Ultrex 82.5SDG 2.4 oz	14 <sup>u</sup>	8	1.5 ab	10.0 b-d	4.5 a-d	7.0 a-d	34.3 e-j	59.5 l-n	8.5 k	7.3 d-h
31. Rotational Program 1	14 <sup>t</sup>	8	0.0 a	1.5 ab	1.0 a	3.5 a-d	39.3 g-l	48.0 h-l	7.5 h-j	6.8 d-f
32. Rotational Program 2	14 <sup>s</sup>	8	0.0 a	1.5 ab	1.0 a	3.5 a-d	39.3 g-l	48.0 h-l	7.5 h-j	6.8 d-f
33. Rotational Program 3	14 <sup>r</sup>	8	0.0 a	1.5 ab	1.0 a	3.5 a-d	39.3 g-l	48.0 h-l	7.5 h-j	6.8 d-f
34. Proxy 2L 5.0 fl oz	Twice <sup>v</sup>	14	0.0 a	4.5 a-c	0.0 a	3.0 a-c	20.5 b-d	37.5 e-i	9.0 l	7.8 f-j
+ Primo MAXX 1MC 0.125 fl oz	---	13	0.0 a	0.5 ab	6.8 a-d	6.3 a-d	38.8 f-l	49.0 i-l	7.8 i-k	7.5 e-i
+ Daconil Ultrex 82.5SDG 2.4 oz	14 <sup>v</sup>	8	0.5 a	5.5 a-c	6.0 a-d	8.5 a-d	47.8 k-l	76.5 o-q	8.5 k	7.3 d-h
35. Daconil Ultrex 82.5SDG 2.4 oz	14	8	0.0 a	1.0 ab	0.0 a	0.8 a	9.8 ab	18.3 bc	9.0 l	8.3 h-j
36. Rotational Program 4	14 <sup>q</sup>	8	0.0 a	1.0 ab	0.0 a	0.8 a	9.8 ab	18.3 bc	9.0 l	8.3 h-j
37. Rotational Program 5	14 <sup>p</sup>	8	0.0 a	0.5 ab	0.0 a	0.0 a	37.8 f-k	48.8 i-l	9.0 l	8.3 h-j
38. Endorse 2.5W 3.0 oz	---	6	0.0 a	3.5 a-c	0.5 a	2.5 ab	27.5 c-g	42.5 g-j	8.8 l	8.0 g-j
+ Daconil Ultrex 82.5SDG 2.4 oz	14	8	0.0 a	3.5 a-c	0.5 a	2.5 ab	27.5 c-g	42.5 g-j	8.8 l	8.0 g-j
39. Medallion 50W 0.188 oz	---	10	0.0 a	0.0 a	0.0 a	0.0 a	17.0 bc	23.5 b-d	9.0 l	8.8 j
+ Daconil Ultrex 82.5SDG 2.4 oz	14	8	0.0 a	0.0 a	0.0 a	0.0 a	17.0 bc	23.5 b-d	9.0 l	8.8 j

(Continued)

Table 2 (continued).

Treatment and Rate per 1000 sq ft	Turf Area Infested (%) per Plot <sup>z</sup>						Turf Quality <sup>y</sup> 25 Aug.		
	Spray Interval	13 Aug.	25 Aug.	8 Sept.	25 Aug.	8 Sept.			
(days) <sup>x</sup> MOA <sup>w</sup>	+N	-N	+N	-N	+N	-N	+N		
40. Untreated Control	---	28.5 h	50.5 gh	64.3 hi	80.8 j	63.8 m	81.0 p-r	4.5 bc	4.3 bc
	INT <sup>o</sup>	DAT <sup>n</sup>		DAT		DAT		DAT	
	Once	93		105		119		105	
	Twice	79		91		105		91	
	14	9		7		21		7	

40

<sup>z</sup> Values are means of four replications. Means followed by the same letter are not significantly different according to Waller-Duncan k-ratio t-test (k = 100).

<sup>y</sup> Turf quality on a 1 to 9 scale, where 9 = best turf quality. Values above 6.0 represent acceptable turf quality.

<sup>x</sup> Fungicides were applied on 12 and 27 May, 9 and 23 June, 7 and 21 July, and 4 and 18 August.

<sup>w</sup> Class = Chemical Class, where 1 = phosphonate, 2 = QoI (includes strobilurin fungicides), 3 = benzimidazole, 4 = macro nutrients P and K, 5 = carboximide, 6 = Polyoxin-D (antibiotic), 7 = sterol biosynthesis inhibitor/demethylation inhibitor, 8 = nitrite, 9 = dithiocarbamate, 10 = phenylpyrrole, 11 = phenylamide, 12 = dicarboximide fungicide class, 13 = class A plant growth regulator, 14 = class E plant growth regulator, and 15 = pyridine pre-emergence herbicide.

<sup>v</sup> For treatments 21 and 34, Proxy 2L was applied twice (12 May and 26 May), whereas Primo MAXX 1MC (treatment 21) and Primo MAXX 1MC + Daconil Ultrex 82.5SDG (treatment 34) were sprayed every 14 days. Phytotoxicity on a 1 to 9 scale, where 1 = no injury, 2 = 1-5%, 3 = 5-15%, 4 = 15-30%, 5 = 30-50%, 6 = 50-70%, 7 = 70-85%, 8 = 85-95%, and 9 = 95-100% foliar necrosis, was observed for treatment 21 (2.5 +N, 5.5 -N on 30 June; 1.0 +N, 1.0 -N on 14 July; 1.0 +N, 1.0 -N on 28 July) and treatment 34 (2.0 +N, 3.5 -N on 30 June; 1.0 +N, 1.0 -N on 14 July; 1.0 +N, 1.0-N on 28 July).

<sup>u</sup> For treatments 26 and 30, Dimension 1EC was only applied once (12 May), whereas Daconil Ultrex 82.5SDG (treatment 30) was applied every 14 days. Phytotoxicity on a 1 to 9 scale, where 1 = 0 injury, 2 = 1-5%, 3 = 5-15%, 4 = 15-30%, 5 = 30-50%, 6 = 50-70%, 7 = 70-85%, 8 = 85-95%, and 9 = 95-100% foliar necrosis, was observed for treatment 26 (6.0 +N, 6.5 -N on 16 June; 5.0 +N, 6.8 -N on 30 June; 7.0 +N, 6.2 -N on 14 July; 5.5 +N, 6.8 -N on 28 July; 3.6+N, 4.0-N on 13 August) and treatment 30 (3.3 +N, 6.3 -N on 16 June; 4.3 +N, 6.5 -N on 30 June; 5.0 +N, 5.2 -N on 14 July; 3.5 +N, 4.8 -N on 28 July; 1.8+N, 2.8-N on 13 August).

(Continued)

Table 2 (continued).

- <sup>t</sup> Rotational Program 1 (modified USGA) was applied as follows: Heritage 50WG (0.2 oz) + Daconil Ultrex 82.5SDG (1.8 oz) on 12 May, Chipco Signature 80WG (4.0 oz) + Fore Rainshield 80W (6.0 oz) on 26 May, Heritage 50WG (0.2 oz) + Daconil Ultrex 82.5SDG (2.4 oz) on 9 June, Chipco Signature 80WG (4.0 oz) + Daconil Ultrex 82.5SDG (2.4 oz) on 23 June, Heritage 50WG (0.2 oz) + Daconil Ultrex 82.5SDG (2.4 oz) on 7 July, Chipco Signature 80WG (4.0 oz) + Fore Rainshield 80W (6.0 oz) on 21 July, Heritage 50WG (0.2 oz) + Daconil Ultrex 82.5SDG (2.4 oz) on 4 August, and Chipco Signature 80WG (4.0 oz) + Daconil Ultrex 82.5SDG (2.4 oz) on 18 August. All rates were per 1000 sq ft.
- <sup>s</sup> Rotational Program 2 (Syngenta) was applied as follows: Banner MAXX 1.3MC (2 fl oz) + Daconil Ultrex 82.5SDG (1.8 oz) + Primo MAXX 1MC (0.125 fl oz) on 12 May, Heritage 50WG (0.4 oz) + Daconil Ultrex 82.5SDG (3.2 oz) + Primo MAXX 1MC (0.125 fl oz) on 27 May, Medallion 50W (0.25 oz) + Daconil Ultrex 82.5SDG (3.2 oz) + Primo MAXX 1MC (0.125 fl oz) on 9 June, Heritage 50WG (0.4 oz) + Banner MAXX 1.3MC (1.0 fl oz) + Primo MAXX 1MC (0.125 fl oz) on 23 June, Medallion 50W (0.25 oz) + Daconil Ultrex 82.5SDG (3.2 oz) + Primo MAXX 1MC (0.125 fl oz) on 7 July, Heritage 50WG (0.4 oz) + Banner MAXX 1.3MC (1.0 fl oz) + Primo MAXX 1MC (0.125 fl oz) on 21 July, Medallion 50W (0.25 oz) + Daconil Ultrex 82.5SDG (3.2 oz) + Primo MAXX 1MC (0.125 fl oz) on 4 August, and Banner MAXX 1.3MC (1.0 fl oz) + Daconil Ultrex 82.5SDG (3.2 oz) + Primo MAXX 1MC (0.125 fl oz) on 18 August. All rates were per 1000 sq ft.
- <sup>r</sup> Rotational Program 3 (Bayer) was applied as follows: Chipco Signature 80WG (4.0 oz) + Chipco 26GT 2SC (4.0 fl oz) on 12 May, Chipco Signature 80WG (4.0 oz) + Daconil Ultrex 82.5SDG (3.2 oz) on 27 May, Chipco Signature 80WG (4.0 oz) + Bayleton 50DF (1.0 oz) + Daconil Ultrex 82.5SDG (3.2 oz) on 9 June, Chipco Signature 80WG (4.0 oz) + Compass 50WG (0.2 oz) + Daconil Ultrex 82.5SDG (3.2 oz) on 23 June, Chipco Signature 80WG (4.0 oz) + Chipco 26GT 2SC (4 fl oz) on 7 July, Chipco Signature 80WG (4.0 oz) + Daconil Ultrex 82.5SDG (3.2 oz) on 21 July, Chipco Signature 80WG (4.0 oz) + Chipco 26GT 2SC (4 fl oz) on 4 August, and Chipco Signature 80WG (4 oz) on 18 August. All rates were per 1000 sq ft.
- <sup>q</sup> Rotational Program 4 (Rutgers) was applied as follows: Chipco 26GT 2SC (4.0 fl oz) on 12 May, Banner MAXX 1.3MC (1 fl oz) on 27 May, Daconil Ultrex 82.5SDG (3.2 oz) on 9 June, Chipco Signature 80WG (4.0 oz) + Daconil Ultrex 82.5SDG (2.4 oz) on 23 June, Medallion 50W (0.188 oz) + Banner MAXX 1.3MC (0.75 fl oz) on 7 July, Chipco Signature 80WG (4.0 oz) + Daconil Ultrex 82.5SDG (2.4 oz) on 21 July, Endorse 2.5W (3.0 oz) + Banner MAXX 1.3MC (0.75 fl oz) on 4 August, and Chipco Signature 80WG (4.0 oz) + Daconil Ultrex 82.5SDG (2.4 oz) on 18 August. All rates were per 1000 sq ft.
- <sup>p</sup> Rotational Program 5 (Rutgers) was applied as follows: Banner MAXX 1.3MC (1.0 fl oz) on 12 May, Daconil Ultrex 82.5SDG (3.2 oz) on 27 May, Chipco 26GT 2SC (4.0 fl oz) on 9 June, Chipco Signature 80WG (4.0 oz) + Daconil Ultrex 82.5SDG (2.4 oz) on 23 June, Endorse 2.5W (3.0 oz) + Daconil Ultrex 82.5SDG (2.4 oz) on 7 July, Chipco Signature 80WG (4.0 oz) + Daconil Ultrex 82.5SDG (2.4 oz) on 21 July, Medallion 50W (0.188 oz) + Daconil Ultrex 82.5SDG (2.4 oz) on 4 August, and Chipco Signature 80WG (4.0 oz) + Daconil Ultrex 82.5SDG (2.4 oz) on 18 August. All rates were per 1000 sq ft.
- <sup>o</sup> Spray interval in days.
- <sup>n</sup> Days after treatment (DAT) for each spray interval.
- <sup>m</sup> ND = No data taken due to phytotoxicity.